

E. coli O157:H7

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

E. coli O157:H7 is one of over a hundred different serotypes belonging to the group of gram negative bacteria *Escherichia coli*, the majority of which are benign to humans. *E. coli* O157:H7 is in the enterohemorrhagic category of strains.

B. Clinical Description

E. coli O157:H7 bacteria produce potent cytotoxins, called Shiga toxins. Infection with *E. coli* O157:H7 may present with a wide spectrum of clinical manifestations. An individual may be asymptomatic, have mild non-bloody diarrhea, or have gross bloody diarrhea. Most diagnosed cases present with an onset of bloody diarrhea 6 to 48 hours after the onset of non-bloody diarrhea. Abdominal cramps, nausea and vomiting may also be present. Fever is usually absent. In severe cases, the patient may progress to develop hemolytic uremic syndrome (HUS) or thrombotic thrombocytopenic purpura (TTP) which can result in renal failure and death.

C. Reservoirs

Cattle appear to be a reservoir of significant public health importance; however, other animals, such as deer, are also known to carry *E. coli* O157:H7. In addition, humans may also serve as a reservoir.

D. Modes of Transmission

Transmission of *E. coli* O157:H7 occurs fecal-orally through food, drinking water or recreational water contaminated with human or animal feces containing the bacterium. Transmission may also occur directly from person-to-person; this can include certain types of sexual contact (*e.g.*, oral-anal contact). The infectious dose is very low. *E. coli* O157:H7 has been associated with the consumption of contaminated ground beef, unpasteurized apple juice and cider, unpasteurized milk and other dairy products, raw vegetables, and salami.

E. Incubation Period

The incubation period is variable, 2 to 8 days (or longer); most commonly 3 to 4 days.

F. Period of Communicability or Infectious Period

E. coli O157:H7 is shed in stool during at least the initial period of diarrhea, then variably for an unknown duration. These bacteria are typically shed for up to 3 weeks in about one-third of infected children.

G. Epidemiology

E. coli O157:H7 was first identified in 1982 in an outbreak in the United States. Since then, infections have been recognized as an important cause of bloody diarrhea in North America, Europe, Japan, Australia and southern South America. As with other enteric illnesses, the young and old are usually more severely ill when infected with *E. coli* O157:H7. Infection in young children may lead to complications such as HUS in about 5 to 10% of cases. Sporadic cases of *E. coli* O157:H7 infection occur throughout the year with a peak in the incidence of disease during the summer months. Outbreaks in the United States have been associated with ground beef, unpasteurized milk and apple cider, and other food products.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. What to Report to the Massachusetts Department of Public Health

Report a case that meets either of the following criteria:

- Isolation of *E. coli* O157:H7 from a clinical specimen; or
- Isolation of shiga toxin-producing *E. coli* O157:NM from a clinical specimen. (Strains of *E. coli* O157:H7 that have lost the flagellar “H” antigen become nonmotile and are designated “NM.”)

Note: See Section 3) C below for information on how to report a case.

B. Laboratory Testing Services Available

The Massachusetts State Laboratory Institute (SLI), Enteric Laboratory will test stool specimens for the presence of *E. coli* O157:H7 and will confirm and serotype isolates obtained from clinical specimens at other laboratories. Additionally, the Enteric Laboratory requests that all laboratories submit *all* isolates cultured for typing to aid in the public health surveillance necessary for this illness. For more information on submitting specimens call the Enteric Laboratory at (617) 983-6609.

The SLI, Food Microbiology Laboratory, available at (617) 983-6616 will test implicated food items from a cluster or outbreak. See Section 4) D, Environmental Measures, for more information.

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify whether the case may be a source of infection for other persons (*e.g.*, a diapered child, daycare attendee or foodhandler) and if so, to prevent further transmission.
- To identify sources of public health concern (*e.g.*, a contaminated food source or recreational water) and to stop transmission from such a source.

B. Laboratory and Healthcare Provider Reporting Requirements

Please refer to the lists of reportable diseases (at the end of this manual’s introductory section) for specific information.

C. Local Board of Health Reporting and Follow-Up Responsibilities

1. Reporting Requirements

Massachusetts Department of Public Health (MDPH) regulations (*105 CMR 300.000*) stipulate that each local board of health (LBOH) must report the occurrence of any case of *E. coli* O157:H7, as defined by the reporting criteria in Section 2) A above. Current requirements are that cases be reported to the MDPH Division of Epidemiology and Immunization, Surveillance Program using an official MDPH *Bacterial and Parasitic Gastroenteritis Case Report Form* (see Appendix A). Refer to the *Local Board of Health Reporting Timeline* (at the end of this manual’s introductory section) for information on prioritization and timeliness requirements of reporting and case investigation.

2. Case Investigation

- a. It is the LBOH responsibility to complete a *Bacterial and Parasitic Gastroenteritis Case Report Form* (in Appendix A) by interviewing the case and others who may be able to provide pertinent information. Much of the information required on the form can be obtained from the case’s healthcare provider or the medical record.
- b. Use the following guidelines to assist you in completing the form:
 - 1) Accurately record the demographic information, date of symptom onset, symptoms, and medical information.
 - 2) When asking about exposure history (food, travel, activities, etc.), use the incubation period range for *E. coli* O157:H7 (3–8 days). Specifically, focus on the period beginning a minimum of 3 days prior to the case’s onset date back to no more than 8 days before onset.

- 3) If possible, record any restaurants at which the case ate, including food item(s) and date consumed. If you suspect that the case became infected through food, use of the MDPH *Foodborne Illness Complaint Worksheet* (located in Appendix A) will facilitate recording additional information. It is requested that LBOHs fax or mail this worksheet to the MDPH Division of Food and Drugs (see top of worksheet for fax number and address). This information is entered into a database to help link other complaints from neighboring towns, thus helping to identify foodborne illness outbreaks. *This worksheet does not replace the Bacterial and Parasitic Gastroenteritis Case Report Form.*
 - 4) Ask questions about travel history and outdoor activities to help identify where the case became infected.
 - 5) Ask questions about water supply because *E. coli* O157:H7 may be acquired through water consumption.
 - 6) Household/close contact, pet or other animal contact, daycare, and foodhandler questions are designed to examine the case's risk of having acquired the illness from, or potential for transmitting it to, these contacts. Determine whether the case attends or works at a daycare facility and/or is a foodhandler.
 - 7) If you have made several attempts to obtain case information, but have been unsuccessful (*e.g.*, the case or healthcare provider does not return your calls or respond to a letter, or the case refuses to divulge information or is too ill to be interviewed), please fill out the case report form with as much information as you have gathered. Please note on the form the reason why it could not be filled out completely.
- c. After completing the case report form, attach lab report(s) and mail (in an envelope marked "Confidential") to the MDPH Division of Epidemiology and Immunization, Surveillance Program. The mailing address is:
- MDPH, Division of Epidemiology and Immunization
Surveillance Program, Room 241
305 South Street
Jamaica Plain, MA 02130
- d. Institution of disease control measures is an integral part of case investigation. It is the LBOH responsibility to understand, and, if necessary, institute the control guidelines listed below in Section 4), Controlling Further Spread.

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (105 CMR 300.200)

Foodhandlers with *E. coli* O157:H7 must be excluded from work. *Note:* A case is defined by the reporting criteria in Section 2) A of this chapter.

Minimum Period of Isolation of Patient

After diarrhea has resolved, foodhandling facility employees may only return to work after producing one negative stool specimen. If a case has been treated with an antimicrobial, the stool specimen shall not be submitted until at least 48 hours after cessation of therapy. In outbreak circumstances, a second consecutive negative stool specimen will be required prior to returning to work.

Minimum Period of Quarantine of Contacts

Contacts with diarrhea who are foodhandling facility employees shall be considered the same as a case and handled in the same fashion. No restrictions otherwise.

Note: A foodhandler is any person directly preparing or handling food. This can include a patient care or child care provider. See glossary for a more complete definition.

B. Protection of Contacts of a Case

None.

C. Managing Special Situations

Daycare

Since *E. coli* O157:H7 may be transmitted person-to-person through fecal-oral transmission, it is important to follow up on cases of *E. coli* O157:H7 in a daycare setting carefully. The MDPH *Health and Safety in Child Care* provides detailed information on case follow-up and control in a daycare setting. (If a case of HUS is diagnosed in a daycare, please see the chapter on HUS for recommendations.) General recommendations include:

- Children with *E. coli* O157:H7 who have diarrhea should be excluded until their diarrhea is gone.
- Children with *E. coli* O157:H7 who have no diarrhea and are otherwise not ill may be excluded or may remain in the program if special precautions are taken.
- Since most staff in child care programs are considered foodhandlers, those with *E. coli* O157:H7 infection (symptomatic or not) can remain on site, but must not prepare food or feed children until their diarrhea is gone and they have one negative stool test (submitted at least 48 hours after completion of antibiotic therapy, if antibiotics are given). (Per 105 CMR 300.200)
- Refer to Chapter 17 of the MDPH *Health and Safety in Child Care* for complete guidelines on handling diseases spread through the intestinal tract.

School

Since *E. coli* O157:H7 may be transmitted person-to-person through fecal-oral transmission, it is important to follow up on cases of *E. coli* O157:H7 in a school setting carefully. The MDPH *Comprehensive School Health Manual* provides detailed information on case follow-up and control in a school setting. (If a case of HUS is diagnosed in a school, please see the chapter on HUS for recommendations.) General recommendations include:

- Students or staff with *E. coli* O157:H7 infection who have diarrhea should be excluded until their diarrhea is gone.
- Students or staff with *E. coli* O157:H7 who do not handle food, have no diarrhea or mild diarrhea and are not otherwise sick, may remain in school if special precautions are taken.
- Students or staff who handle food and have *E. coli* O157:H7 infection (symptomatic or not) must not prepare food until their diarrhea is gone and they have one negative stool test (submitted at least 48 hours after completion of antibiotic therapy, if antibiotics are given). (Per 105 CMR 300.200)
- Refer to Chapter 8 of the MDPH *Comprehensive School Health Manual* for complete guidelines on handling diseases spread through the intestinal tract.

Community Residential Programs

Actions taken in response to a case of *E. coli* O157:H7 in a community residential program will depend on the type of program and the level of functioning of the residents.

In long-term care facilities, residents with *E. coli* O157:H7 should be placed on standard (including enteric) precautions until their symptoms subside *and* they have one negative stool test for *E. coli* O157:H7. (Refer to the Division of Epidemiology and Immunization's *Control Guidelines for Long-Term Care Facilities* for further actions. A copy can be obtained by calling the Division at 617-983-6800 or 888-658-2850.) Staff members who give direct patient care (*e.g.*, feed patients, give mouth or denture care, or give medications) are

considered foodhandlers and are subject to foodhandler restrictions under *105 CMR 300.200*. See Section 4) A above. In addition, staff members with *E. coli* O157:H7 infection who are not foodhandlers should not work until their diarrhea is gone.

In residential facilities for the developmentally disabled, staff and clients with *E. coli* O157:H7 must refrain from handling or preparing food for other residents until their diarrhea has subsided and they have one negative stool test for *E. coli* O157:H7 (submitted at least 48 hours after completion of antibiotic therapy, if antibiotics are given). (Per *105 CMR 300.200*.) In addition, staff members with *E. coli* O157:H7 infection who are not foodhandlers should not work until their diarrhea is gone.

Reported Incidence Is Higher than Usual/Outbreak Suspected

If the number of reported cases in your city/town is higher than usual, or if you suspect an outbreak, investigate clustered cases in an area or institution to determine source of infection and mode of transmission. A common vehicle (such as water, food or association with a daycare center) should be sought and applicable preventive or control measures should be instituted. Control of person-to-person transmission requires special emphasis on personal cleanliness and sanitary disposal of feces. Consult with the epidemiologist on-call at the Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850. The Division can help determine a course of action to prevent further cases and can perform surveillance for cases that may cross several town lines and therefore be difficult to identify at a local level.

Note: Refer to the MDPH's *Foodborne Illness Investigation and Control Reference Manual* for comprehensive information on investigating foodborne illness complaints and outbreak. (Copies of this manual were distributed to local boards of health in 1997–98. It can also be located on the MDPH website in PDF format at <<http://www.magnet.state.ma.us/dph/fpp/refman.htm>>.) For recent changes (fall of 2000) to the Massachusetts Food Code, contact the Division of Food and Drugs, Food Protection Program at (617) 983-6712 or through the MDPH website at <<http://www.state.ma.us/dph/fpp/>>.

D. Preventive Measures

Environmental Measures

Implicated food items must be removed from the environment. A decision about testing implicated food items can be made in consultation with the Division of Food and Drugs (DFD) or the Division of Epidemiology and Immunization. DFD can help coordinate pickup and testing of food samples. If a commercial product is suspected, DFD will coordinate follow-up with relevant outside agencies. DFD is reachable at (617) 983-6712.

Note: The role of the DFD is to provide policy and technical assistance with the environmental investigation such as interpreting the Massachusetts Food Code, conducting a HACCP risk assessment, initiating enforcement actions and collecting food samples.

The general policy of the SLI is only to test food samples implicated in suspected outbreaks, not single cases (except when botulism is suspected). The LBOH may suggest that the holders of food implicated in single case incidents locate a private laboratory which will test food or store the food in their freezer for a period of time in case additional reports are received. However, a single, confirmed case with leftover food consumed within the incubation period may be considered for testing.

Note: Refer to the MDPH's *Foodborne Illness Investigation and Control Reference Manual* for comprehensive information in investigating foodborne illness complaints and outbreak.

Other environmental measures include:

- Follow recommended procedures for coliform testing of recreational water supplies (*e.g.*, pools, lakes). Contact the Division of Community Sanitation at (617) 983-6761 for more information.
- Follow recommended guidelines for the proper washing/brushing of apples at cider-making facilities. Contact the Division of Food and Drugs, Food Protection Program at (617) 983-6712 for more information.

Personal Preventive Measures/Education

To avoid exposure, advise individuals:

- To always wash their hands thoroughly with soap and water before eating or preparing food, after using the toilet and after changing diapers. (After changing diapers, wash the child's hands.)
- In a daycare setting, to dispose of feces in a sanitary manner.
- When caring for someone with diarrhea, to scrub their hands with plenty of soap and water after cleaning the bathroom, helping the person use the toilet, or changing diapers, soiled clothes or soiled sheets.
- Avoid sexual practices that may permit fecal-oral transmission. Latex barrier protection should be emphasized as a way to prevent the spread of *E. coli* O157:H7 to case's sexual partners as well as being a way to prevent the exposure to and transmission of other pathogens.
- If diagnosed with *E. coli* O157:H7, to seek medical attention if symptoms compatible with HUS occur. (See chapter on HUS.)
- To keep food that will be eaten raw, such as vegetables, from becoming contaminated by animal-derived food products. (Wash fruits and vegetables thoroughly, especially those that will not be cooked.)
- If served an undercooked hamburger or other ground beef product in a restaurant, to send it back for further cooking.
- To cook all ground beef and hamburger thoroughly.
- To drink only pasteurized milk, juice, or cider.

An *E. coli* O157:H7 *Public Health Fact Sheet* can be obtained from the Division of Epidemiology and Immunization or through the MDPH website at <<http://www.state.ma.us/dph/>>. Click on the "Publications" link and scroll down to the Fact Sheets section. It is also available in Spanish.

ADDITIONAL INFORMATION

The formal Centers for Disease Control and Prevention (CDC) surveillance case definition for *E. coli* O157:H7 is the same as the criteria outlined in Section 2) A of this chapter. (CDC case definitions are used by the state health department and CDC to maintain uniform standards for national reporting.) For reporting a case to the MDPH, always refer to the criteria Section 2) A.

REFERENCES

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